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Tuttle

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(54) **ELECTRONIC COMMUNICATION DEVICES, METHODS OF FORMING ELECTRICAL COMMUNICATION DEVICES, AND COMMUNICATIONS METHODS**

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See application file for complete search history.

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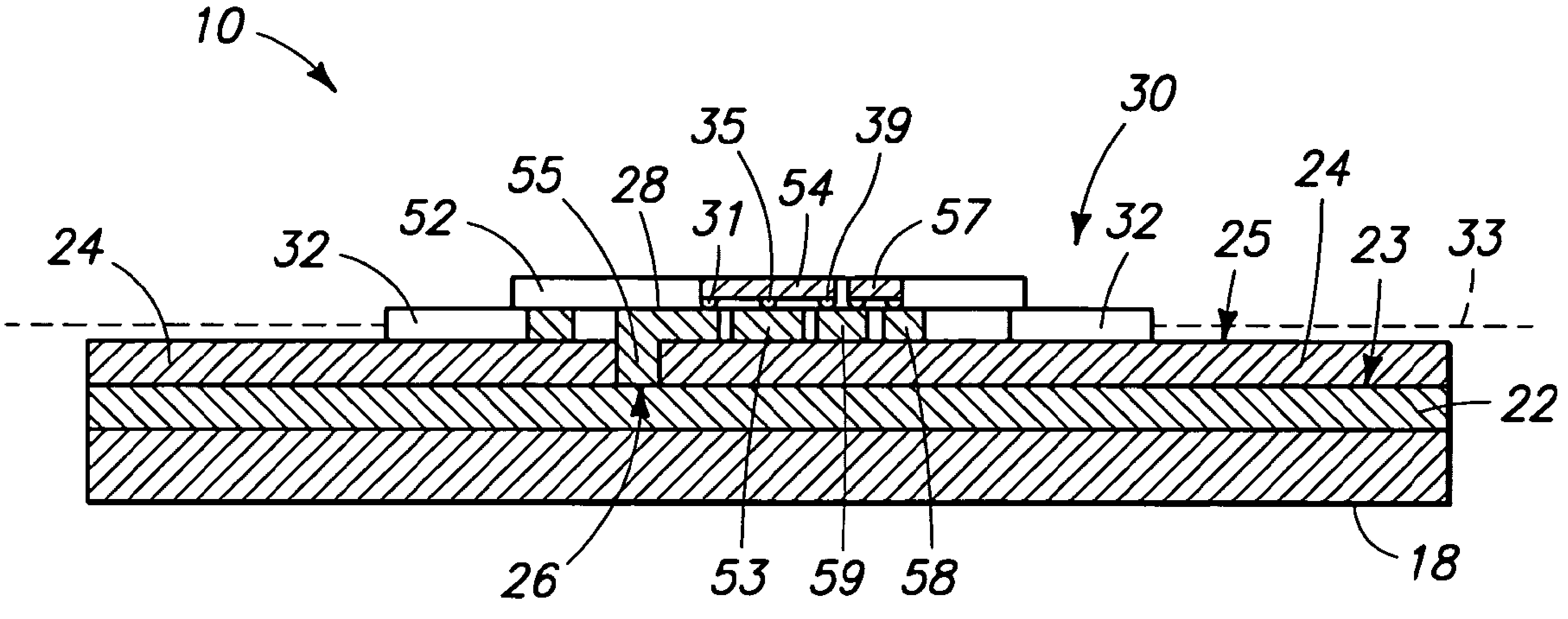
(57) **ABSTRACT**

The present invention provides electronic communication devices, methods of forming electrical communication devices, and communications methods. An electronic communication device adapted to receive electronic signals includes: a housing comprising a substrate and an encapsulant; an integrated circuit provided within the housing and comprising transponder circuitry operable to communicate an identification signal responsive to receiving a polling signal; an antenna provided within the housing and being coupled with the transponder circuitry; and a ground plane provided within the housing and being spaced from the antenna and configured to shield some of the electronic signals from the antenna and reflect others of the electronic signals towards the antenna. A method of forming an electronic signal communication device includes providing a substrate having a support surface; providing a conductive layer adjacent at least a portion of the support surface; providing a dielectric layer over the conductive layer; providing an antenna over the dielectric layer; coupling an integrated circuit with the antenna; and encapsulating the antenna, the dielectric layer, and the integrated circuit using a flowable encapsulant.

41 Claims, 4 Drawing Sheets



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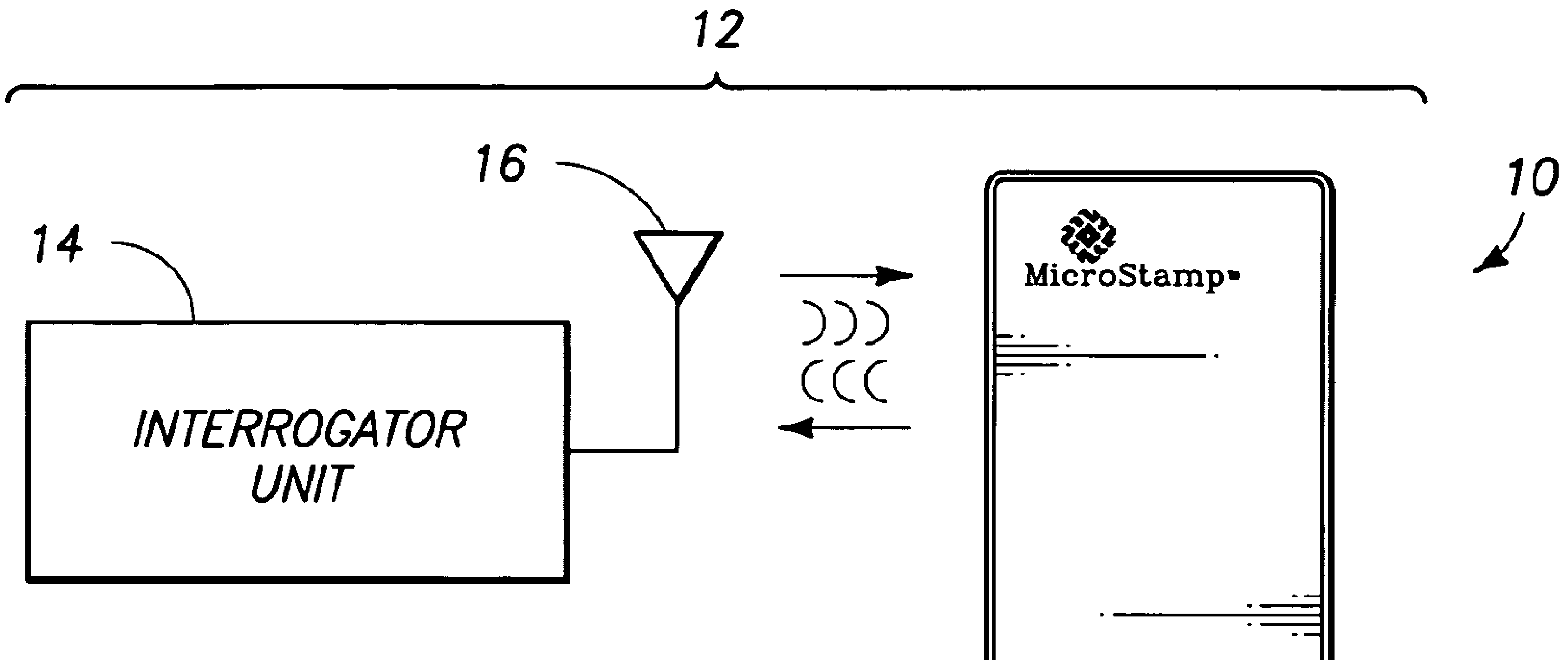

Fig 1

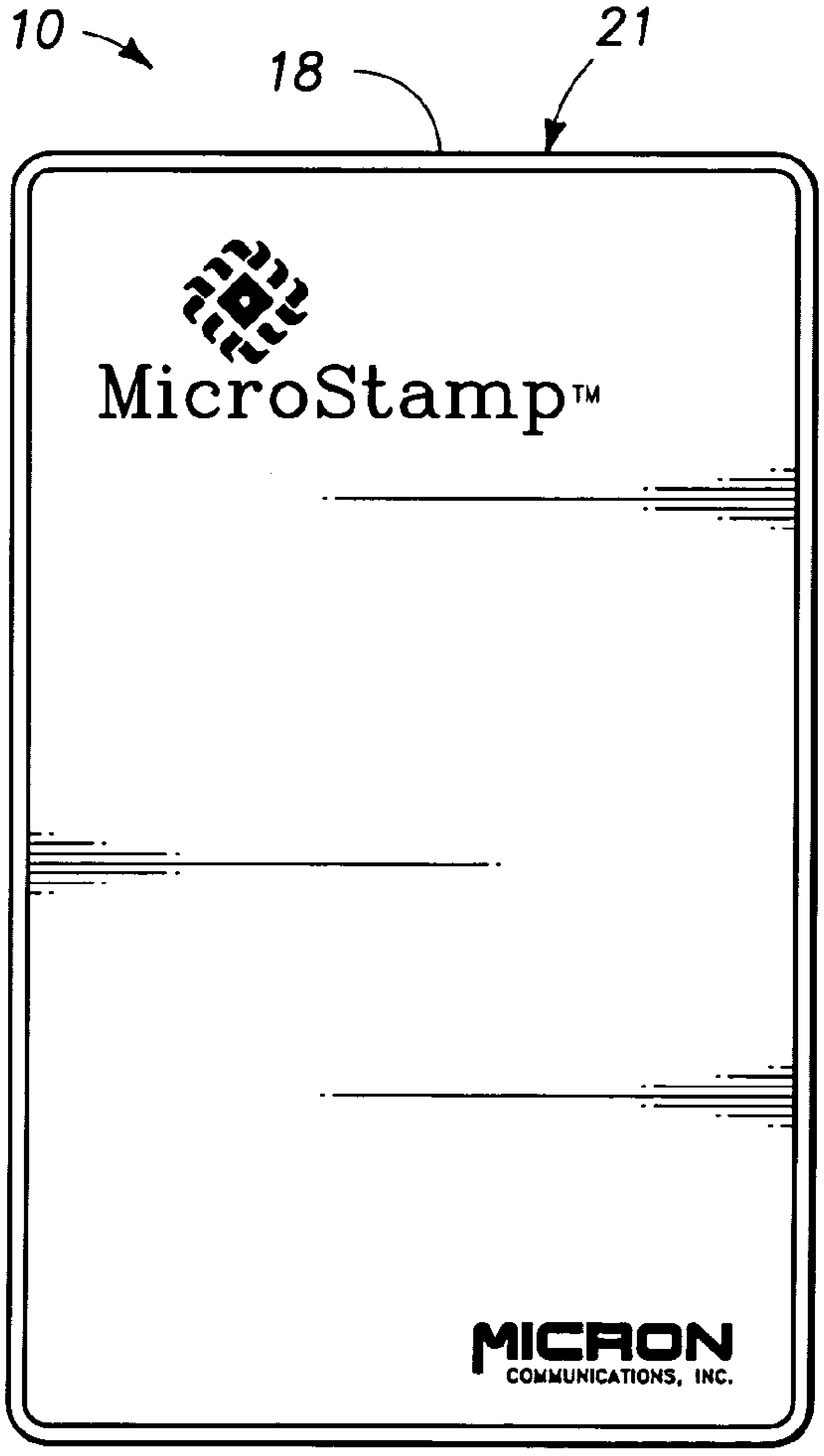

Fig 2

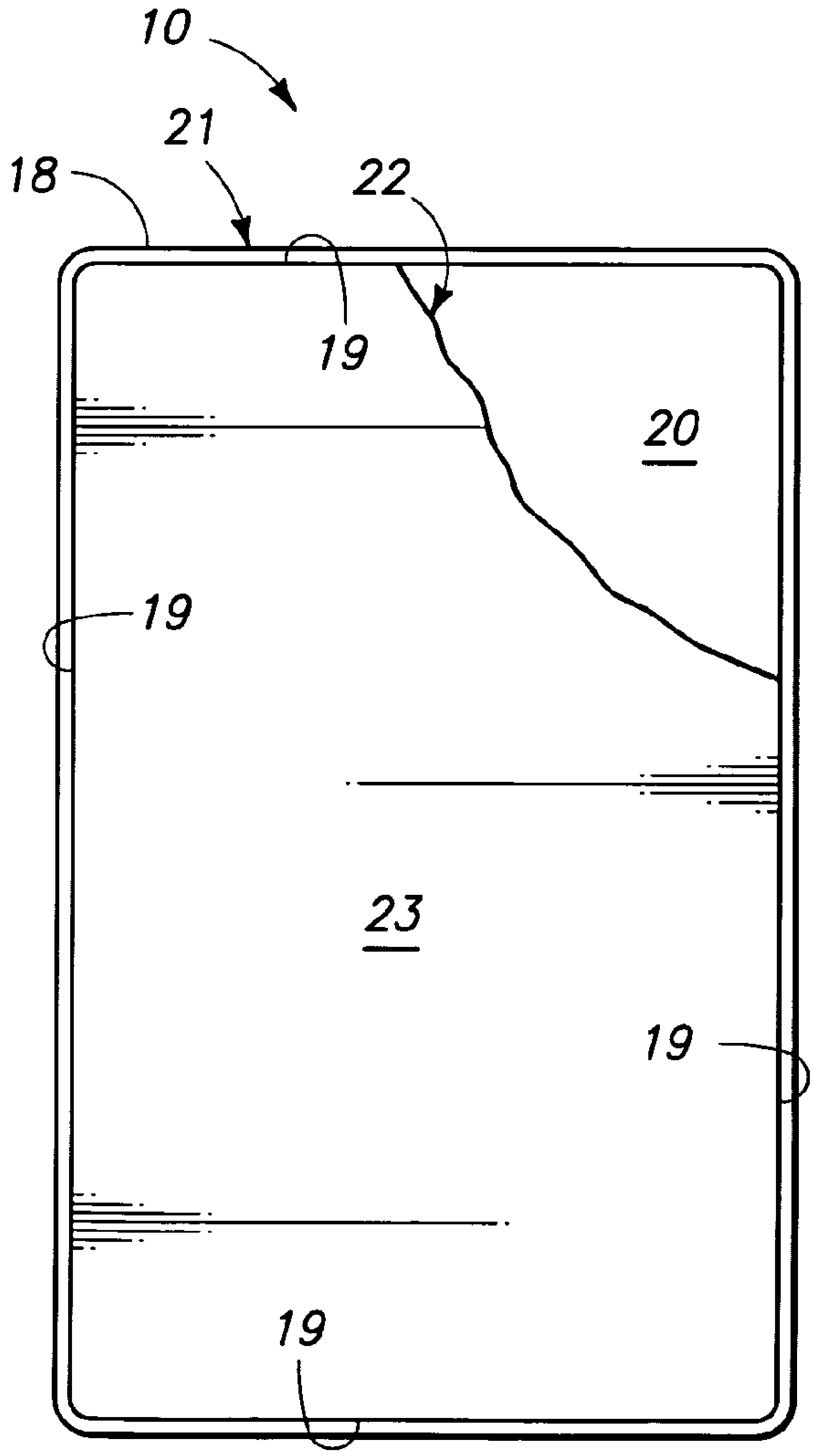

Fig 3

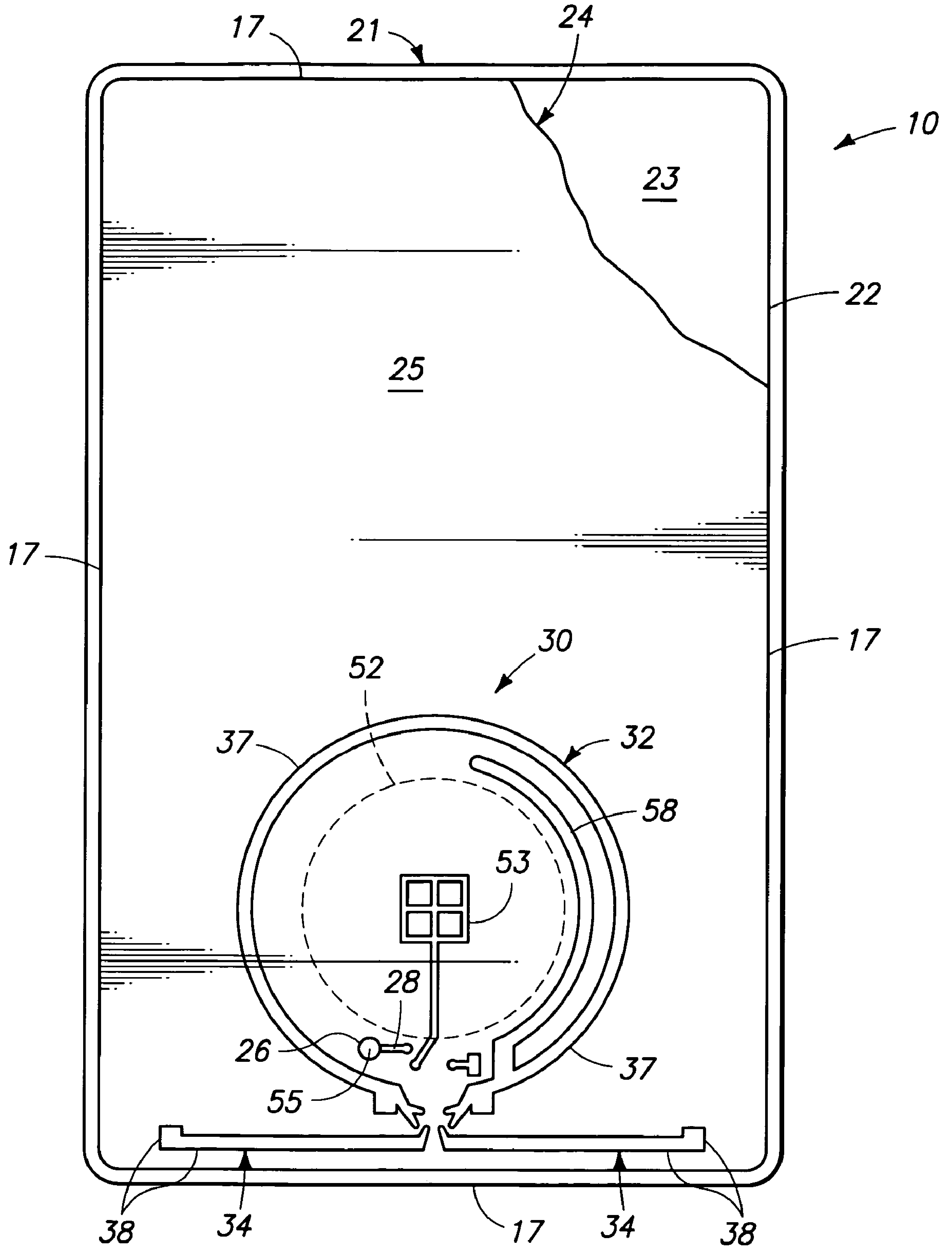

FIG 4

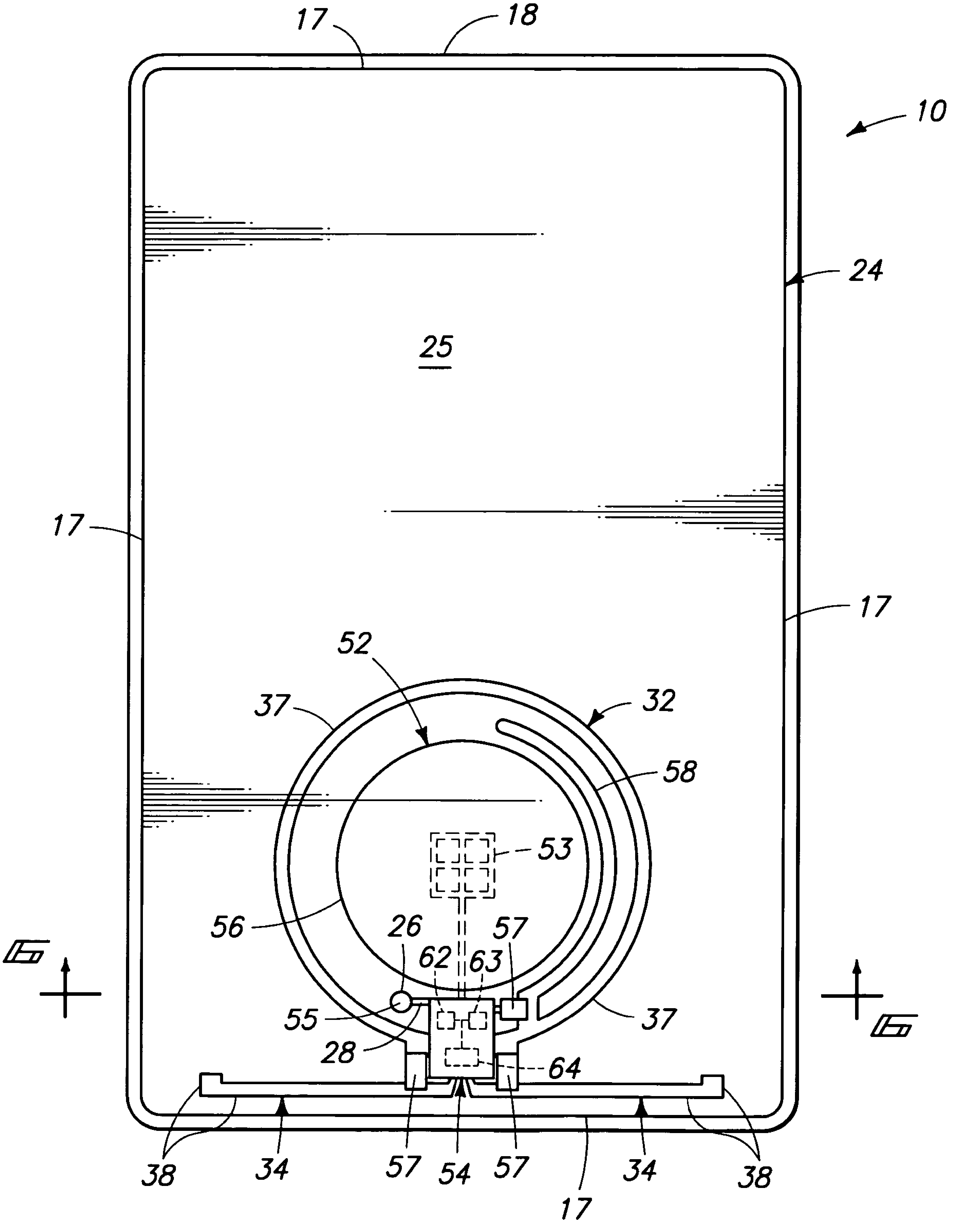
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Fig 5

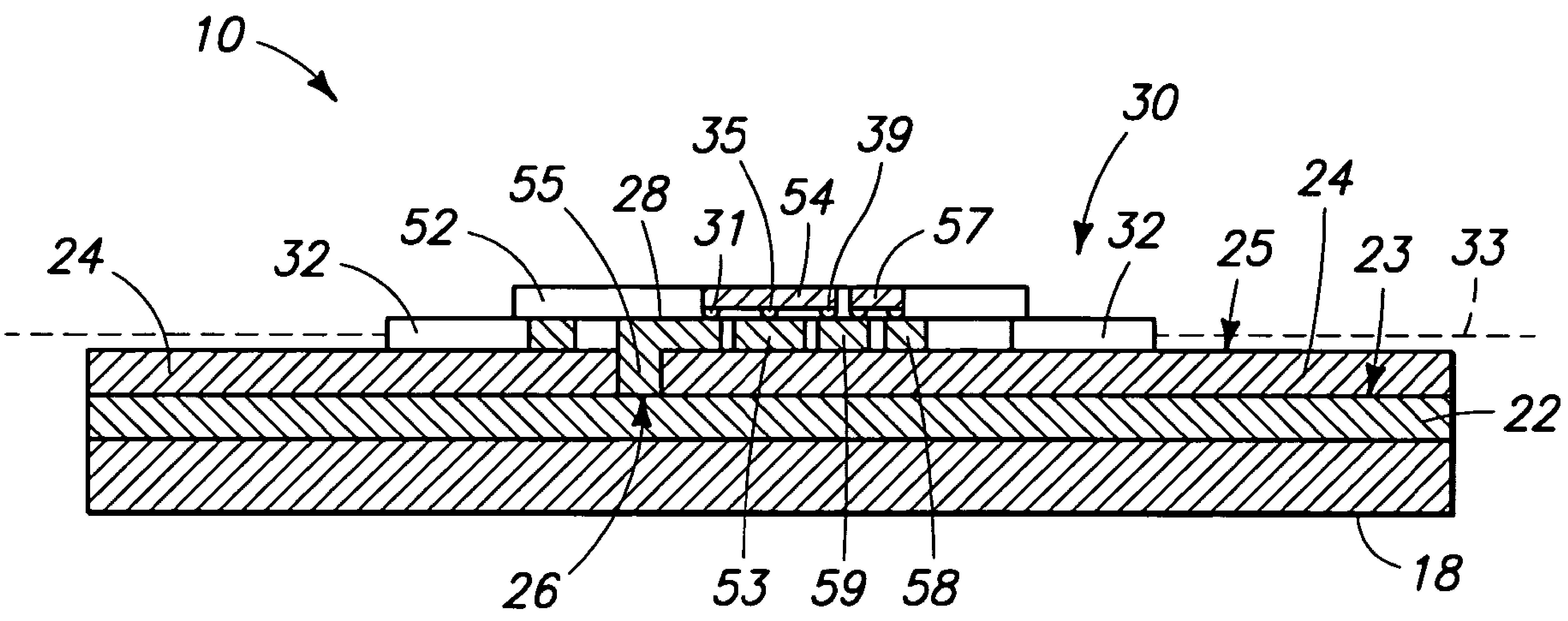
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Fig 6

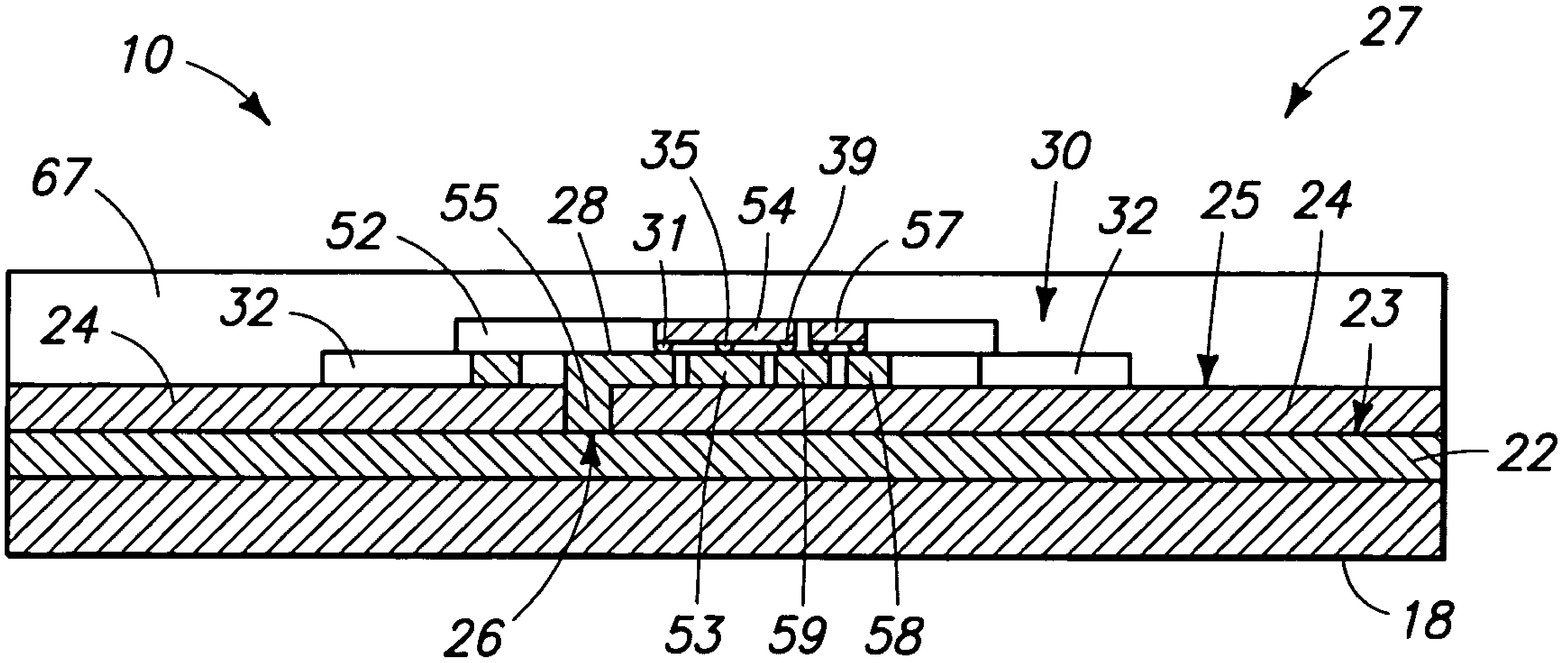
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Fig 7

ELECTRONIC COMMUNICATION DEVICES, METHODS OF FORMING ELECTRICAL COMMUNICATION DEVICES, AND COMMUNICATIONS METHODS

RELATED PATENT DATA

This patent resulted from a continuation of and claims priority to U.S. patent application Ser. No. 09/988,485, filed on Nov. 20, 2001, now U.S. Pat. No. 7,106,201, issued Sep. 12, 2006, entitled "Communication Devices, Remote Intelligent Communication Devices, Electronic Communication Devices, Methods of Forming Remote Intelligent Communication Devices and Methods of Forming a Radio Frequency Identification Device", naming Mark E. Tuttle as inventor, which is a continuation application of U.S. patent application Ser. No. 08/926,595, filed Aug. 20, 1997, entitled "Electronic Communication Devices, Methods of Forming Electrical Communication Devices and Communication Methods", naming Mark E. Tuttle as inventor, now U.S. Pat. No. 6,339, 385 which issued Jul. 15, 2002, the disclosures of which are incorporated herein by reference.

TECHNICAL FIELD

The present invention relates to electronic communication devices, methods of forming electrical communication devices, and communications methods.

BACKGROUND OF THE INVENTION

Electronic identification systems typically comprise two devices which are configured to communicate with one another. Preferred configurations of the electronic identification systems are operable to provide such communications via a wireless medium.

One such configuration is described in U.S. patent application Ser. No. 08/705,043, filed Aug. 29, 1996, assigned to the assignee of the present application and incorporated herein by reference. This application discloses the use of a radio frequency (RF) communication system including an interrogator and a transponder such as a tag or card.

The communication system can be used in various identification and other applications. The interrogator is configured to output a polling signal which may comprise a radio frequency signal including a predefined code. The transponders of such a communication system are operable to transmit, reflect or backscatter an identification signal responsive to receiving an appropriate polling signal. More specifically, the appropriate transponders are configured to recognize the predefined code. The transponders receiving the code subsequently output a particular identification signal which is associated with the transmitting transponder. Following transmission of the polling signal, the interrogator is configured to receive the identification signals enabling detection of the presence of corresponding transponders.

Such communication systems are useable in identification applications such as inventory or other object monitoring. For example, a remote identification device is attached to an object of interest. Responsive to receiving the appropriate polling signal, the identification device is equipped to output the appropriate identification signal. Generating the identification signal identifies the presence or location of the article or object.

Such identification systems configured to communicate via radio frequency signals are susceptible to incident RF radiation. Reflected RF radiation can cause problems in environments having metal structures. For example, application of transponders to objects comprising metal may result in decreased or no performance depending on the spacing of the transponder antenna to the nearest metal on the object.

Therefore, there exists a need to reduce the effects of incident RF radiation upon the operation of communication devices of an electronic identification system.

SUMMARY OF THE INVENTION

According to one embodiment of the invention, an electronic communication device, such as a remote intelligent communication device and a radio frequency identification device, is provided which includes a substrate, conductive layer, at least one antenna and an integrated circuit. The integrated circuit includes at least one of a modulator and receiver. The conductive layer is configured as a ground plane to interact with the antenna. In particular, the ground plane shields some electronic signals from the antenna while reflecting other electronic signals toward the antenna. The conductive layer is preferably coupled with a power source which electrically grounds the conductive layer.

In one aspect of the invention, a radio frequency identification device comprises an integrated circuit including a receiver, a modulator and a processor; an antenna operably coupled with the integrated circuit and configured to at least one of transmit and receive electronic signals; and a conductive layer spaced from and configured to interact with the antenna.

The integrated circuit comprises transponder circuitry in accordance with other aspects of the present invention. The transponder circuitry is configured to output an identification signal responsive to receiving a polling signal from an interrogator.

Additional aspects of the present invention provide methods of forming an electronic signal communication device and a radio frequency identification device. One embodiment provides an encapsulant to form a portion of a housing. Further, the invention provides for methods of operating a radio frequency identification device and methods of communicating including shielding and reflecting electronic signals.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are described below with reference to the following accompanying drawings.

FIG. **1** is a block diagram of an electronic communication system including an interrogator and an electronic communication device embodying the invention.

FIG. **2** is a front elevational view of the electronic communication device.

FIG. **3** is a rear elevational view of the electronic communication device.

FIG. **4** is a front elevational view of the electronic communication device at an intermediate processing step.

FIG. **5** is a front elevational view of the electronic communication device at an intermediate processing step downstream of the step shown in FIG. **4**.

FIG. **6** is cross-sectional view, taken along line **6-6**, of the electronic communication device shown in FIG. **5**.

FIG. **7** is a cross-sectional view, similar to FIG. **6**, showing a housing of the electronic communication device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

This disclosure of the invention is submitted in furtherance of the constitutional purposes of the U.S. Patent Laws "to promote the progress of science and useful arts" (Article 1, Section 8).

The disclosure of the present invention discloses embodiments of various electronic communication devices. The electronic communication devices are fabricated in card configurations (which include tags or stamps) according to first and second aspects of the present invention. The embodiments are illustrative and other configurations of the electronic communication device according to the present invention are possible. Certain embodiments of the electronic communication devices comprise radio frequency identification devices (RFID) and remote intelligent communication devices (RIC). According to additional aspects of the present invention, methods of forming an electronic communication device and a radio frequency identification device are also provided. The present invention also provides a method of communicating and methods of operating a radio frequency identification device.

Referring to FIG. **1**, a remote intelligent communication device or electronic communication device **10** comprises part of a communication system **12**. The remote intelligent communication device is capable of functions other than the identifying function of a radio frequency identification device. A preferred embodiment of the remote intelligent communication device includes a processor.

The communication system **12** shown in FIG. **1** further includes an interrogator unit **14**. An exemplary interrogator **14** is described in detail in U.S. patent application Ser. No. 08/806,158, filed Feb. 25, 1997, assigned to the assignee of the present application and incorporated herein by reference. The electronic communication device **10** communicates via electronic signals, such as radio frequency (RF) signals, with the interrogator unit **14**. Electronic signals or radio frequency signals including microwave signals are utilized for communications in a preferred embodiment of communication system **12**.

The communication system **12** further includes an antenna **16** coupled to the interrogator unit **14**. An exemplary radio frequency communication system is described in U.S. patent application Ser. No. 08/705,043, which was incorporated above.

Referring to FIG. **2**, the electronic communication device **10** includes an insulative substrate or layer of supportive material **18**. The term "substrate" as used herein refers to any supporting or supportive structure, including but not limited to, a supportive single layer of material or multiple layer constructions. Example materials for the substrate **18** comprise polyester, polyethylene or polyimide film having a thickness of 4-6 mils (thousandths of an inch). A plurality of ink layers (not shown) are applied to substrate **18** in other embodiments of the invention. Substrate **18** provides an outer periphery **21** of device **10**. The substrate **18** defines a first portion of a housing for the electronic communication device **10**.

Referring to FIG. **3**, substrate **18** includes a support surface **20**. A conductive layer **22** is formed or applied over the support surface **20** of substrate **18**. Alternatively, conductive layer **22** could be provided directly on substrate **18** by the supplier of such substrate material or applied directly thereon by the manufacturer of the device. In the illustrated embodiment, conductive layer **22** covers the entire support surface **20** providing an electrically conductive upper surface **23**. A portion of conductive layer **22** has been peeled away in FIG. **3** to reveal a portion of support surface **20** of substrate **18** therebelow. The illustrated conductive layer **22** defines a plurality of outer peripheral edges **19** adjacent periphery **21**.

Alternatively, conductive layer **22** is formed to cover predefined portions of the support surface **20**. In the embodiments wherein conductive layer **22** is patterned, the layer is preferably formed adjacent support surface **20** and an antenna formed in subsequent process steps, described in detail below. Example materials for conductive layer **22** include copper, graphite or a conductive polymer. Conductive layer **22** is substantially planar in a preferred embodiment of the invention. A preferred thickness range is from 100 Angstroms to 100 microns.

Referring to FIG. **4**, an intermediate processing step following the providing of conductive layer **22** is described. In one embodiment, a dielectric layer **24** having a dielectric surface **25** is provided such as by deposition upon the entire upper surface **23** of conductive layer **22**. A portion of dielectric layer **24** has been peeled away in FIG. **4** to reveal a portion of surface **23** of conductive layer **22** therebelow. The illustrated dielectric layer **24** has a plurality of outer peripheral edges **17** adjacent periphery **21**. Alternatively, layer **24** comprises a patterned insulating material which covers predefined portions of conductive surface **23** in another embodiment of the invention.

Exemplary thicknesses of dielectric layer **24** are from 100 microns to 30 mils. It is preferred to provide a dielectric layer **24** comprising a material having a low dielectric constant. Therefore, the circuitry including an antenna to be formed over the dielectric layer **24** can be provided spaced far apart from conductive layer **22**. An exemplary material of dielectric layer **24** is a self-supporting polyester film similar to substrate **18**.

An opening or via **26** is provided through dielectric layer **24**, such **4** as by etching. Alternatively, via **26** can be etched or otherwise cut into the polyester film dielectric layer **24** prior to the application thereof to conductive layer **22**.

After provision of the conductive layer **22** and dielectric layer **24**, a patterned conductive trace **30** is formed or applied over the substrate **18** directly atop the dielectric layer **24** and dielectric surface **25** thereof. A preferred conductive trace **30** comprises silver ink or printed thick film (PTF). One manner of forming or applying the conductive ink is to screen or stencil print the ink on the dielectric layer **24** through conventional screen printing techniques. The conductive ink forms desired electrical connections with and between electronic components which will be described below. In instances where substrate **18** forms a portion of a larger roll of polyester film material, the printing of conductive trace **30** can take place simultaneously for a number of the to-be-formed electronic communication devices.

Conductive trace **30** forms conductive connections **28**, **55** in the illustrated embodiment. Connections **28**, **55** provide electrical connection of integrated circuitry to and through via **26**. The illustrated conductive trace **30** further provides antennas **32**, **34** which are suitable for respectively transmitting and receiving electronic signals or RF energy. The illustrated antenna **32** constitutes a loop antenna having outer peripheral edges **37**. Antenna **34** comprises outer peripheral edges **38**.

Other antenna constructions of antennas **32**, **34** are possible. In alternative embodiments of the present invention, only a single antenna such as antenna **32** is provided for both transmit and receive operations. In a preferred embodiment, conductive connections **28**, **55** and antennas **32**, **34** are formed in a common printing step.

The substrate **18** includes outer periphery **21** inside of which a portion, and preferably the entire antennas **32**, **34** extend or lie. In particular, edges **37**, **38** of respective antennas **32**, **34** are preferably provided within the confines of peripheral edges **19** of conductive layer **22** and peripheral edges **17** of dieletric layer **24**. According to one embodiment, antenna **32** has a length within the range of 80 mm-95 mm and is tuned to 2.45 GHz.

Conductive trace **30** additionally includes a plurality of power source terminals, including a first connection terminal **53** and a second connection terminal **58**. Connection terminals **53**, **58** are formed on dielectric surface **25** of device **10**.

Conductive layer **22** can be used to operate as a ground plane and interact with antennas **32**, **34**. In particular, conductive layer **22** can be used to form a radio frequency (RF) shield. Inasmuch as the preferred embodiment of electronic communication device **10** communicates via wireless signals, it is desired to reduce or minimize interference, such as incident RF radiation. Conductive layer **22** interacts with antenna **32**, **34** to improve RF operation.

In one embodiment, conductive layer **22** operates to shield some electronic signals from the antennas **32**, **34** and reflect other electronic signals toward the antennas **32**, **34**. Conductive layer **22** includes a first side, which faces away from antennas **32**, **34** (opposite surface **23**) and a second side, which faces antenna **32**, **34** (same as surface **23**). Electronic signals received on the first side of the conductive layer **22** are shielded or blocked by layer **22** from reaching the antennas **32**, **34**. Electronic signals received on the second side of the conductive layer **22** which pass by or around antennas **32**, **34** are reflected by layer **22**. Such shielding and reflecting by conductive layer **22** provides a highly directional electronic communication device **10**. The providing of conductive layer **22** within electronic communication device **10** results in increased reliability in the wireless communications with interrogator **14**.

One embodiment of an electronic communication device **10** provides for a power source **52** (shown in phantom in FIG. **4**). The power source **52** is disposed within antenna **32** in one embodiment of electronic communication device **10**. A plurality of power source terminals, including first connection terminal **53** and a second connection terminal **58**, are formed on dielectric surface **25** in the illustrated device **10**.

Referring to FIGS. **4-6**, power source **52** and an integrated circuit **54** are provided and mounted on dielectric surface **25** and supported by substrate **18**. Other components including capacitors **57** may also be mounted on surface **25**. Power source **52** provides operational power to the electronic communication device **10** and selected components therein, including integrated circuit **54**. In the illustrated embodiment, power source **52** is a battery. The battery is preferably a thin profile battery which includes first and second terminals of opposite polarity. More particularly, the battery has a lid or negative (i.e., ground) terminal or electrode, and a can or positive (i.e., power) terminal or electrode.

Conductive epoxy is applied over desired areas of the dielectric surface **25** using conventional printing techniques, such as stencil printing, to assist in component attachment described just below. Alternately, solder or another conductive material is employed instead of conductive epoxy. The power source **52** is provided and mounted on dielectric surface **25** using the conductive epoxy. Integrated circuit **54** is also provided and mounted or conductively bonded on the dielectric surface **25** using the conductive epoxy. Integrated circuit **54** can be mounted either before or after the power source **52** is mounted on the dielectric surface **25**.

Integrated circuit **54** includes suitable circuitry for an electronic communication device **10**. For example, in one embodiment, the integrated circuit **54** includes a processor **62**, memory **63**, and transponder circuitry **64** for providing wireless communications with interrogator unit **14**. An exemplary and preferred integrated circuitry package **54** is described in U.S. patent application Ser. No. 08/705,043 incorporated by reference above.

Transponder circuitry **64** includes a modulator and a receiver. The receiver is configured to receive electronic signals and the modulator is configured to output or communicate electronic signals. The modulator comprises an active transmitter or a backscatter device according to certain embodiments of the present invention. Such outputting or communicating of the electronic signal via the modulator comprises one of transmitting the electronic signal and reflecting a received signal in the described embodiments.

When configured as an active transmitter, the modulator of transponder circuitry **64** is operable to transmit an electronic signal such as a identification signal responsive to the receiver receiving a polling signal. Processor **62** is configured to process the polling signal to detect a predefined code within the polling signal. Responsive to detection of an appropriate polling signal, processor **62** instructs transponder circuitry **64** to output or communicate an identification signal. The identification signal contains an appropriate code to identify the particular device **10** transmitting the identification signal.

Alternatively, when embodied as a backscatter device, the modulator of transponder circuitry **64** operates to selectively reflect a received electronic signal following processing of the signal within processor **62**. The reflected signal also serves to identify the particular device **10** communicating the reflected signal.

First and second connection terminals **53**, **58** are coupled to the integrated circuit **54** by conductive epoxy in accordance with a preferred embodiment of the invention. The conductive epoxy also electrically connects the first terminal of the power source **52** to the first connection terminal **53** (shown in phantom in FIG. **5**). In the illustrated embodiment, power source **52** is placed lid down such that the conductive epoxy makes electrical contact between the negative terminal of the power source **52** and the first connection terminal **53**.

Power source **52** has a perimetral edge **56**, defining the second power source terminal, which is disposed adjacent second connection terminal **58**. In the illustrated embodiment, perimetral edge **56** of the power source **52** is cylindrical, and the connection terminal **58** is arcuate and has a radius slightly greater than the radius of the power source **52**, so that connection terminal **58** is closely spaced apart from the edge **56** of power source **52**.

Subsequently, conductive epoxy is dispensed relative to perimetral edge **56** and electrically connects perimetral edge **56** with connection terminal **58**. In the illustrated embodiment, perimetral edge **56** defines the can of the power source **52**, such that the conductive epoxy connects the positive terminal of the power source **52** to connection terminal **58**. The conductive epoxy is then cured.

Referring specifically to FIG. **6**, first connection terminal **53** is shown coupled with a first pin **35** of integrated circuit **54**. Antenna **32** is additionally coupled with integrated circuit **54** providing electrical connection for the transfer of signals corresponding to the wireless signals or RF energy transmitted and received by antenna **32**. The illustrated capacitor **57** is shown coupled with connection terminal **58** and the integrated circuit **54** via a connection **59**.

Antenna **32** defines a plane **33** which is substantially parallel to conductive layer **22** in the embodiment of electronic communication device **10** shown in FIG. **6**. Although not shown in FIG. **6**, antenna **34** may also define a plane substantially parallel to conductive layer **22**.

The illustrated integrated circuit **54** is shown electrically coupled with the conductive layer **22**. Connection **28** provides electrical connection of integrated circuit **54** and via **26**. Conductive connection **55** provided within via **26** provides electrical connection through via **26** to conductive layer **22**. Connections **28**, **55** operate to conductively bond integrated circuit **54** and conductive layer **22** through pin **31**.

The conductive bonding of integrated circuit **54** with conductive connections **28**, **55** and antennas **32**, **34** is provided in a single processing step in accordance with the preferred embodiment of the present invention.

In one embodiment, conductive layer **22** is electrically coupled with the ground (i.e., negative) terminal of power source **52** through the integrated circuit **54**. In particular, the ground terminal of power source **52** is coupled with the V_{ss} node of integrated circuit **54** via connection terminal **53**. The conductive layer **22** is electrically coupled with the V_{ss} node and the negative terminal of power source **52** via conductive connection **28**, **55** and third pin **31** of integrated circuit **54**. It follows that a common reference voltage is established within integrated circuit **54** and conductive layer **22**. In an alternative embodiment (not shown), conductive layer **22** is coupled directly with the ground electrode of the power source **52**.

Further alternatively, no electrical connection is made to ground plane/conductive layer **22**. In such an embodiment, ground plane/conductive layer **22** is insulated and the voltage of layer **22** is permitted to float.

Referring to FIG. **7**, an encapsulant, such as encapsulating epoxy material **67**, is subsequently formed to encapsulate the substrate **18** to cover the integrated circuit **54**, power source **52**, conductive circuitry **30**, and a portion of the dielectric layer **24**, and to define a portion of a housing **27** for the electronic communication device **10**. Housing **27** also comprises substrate **18** in addition to the encapsulating epoxy material **67**. In one embodiment, housing **27** of electronic communication device **10** has a width of about 3.375 inches, a height of about 2.125 inches, and a thickness less than or equal to about 0.090 inch.

An exemplary encapsulant is a flowable encapsulant. The flowable encapsulant is subsequently cured following the appropriate covering of the integrated circuit **54**, power source **52**, conductive circuitry **30**, and the dielectric layer **24**, forming a substantially void-free housing or solid mass. In the illustrated embodiment, such epoxy **67** constitutes a two-part epoxy having a resin and a hardener which are sufficient to provide a desired degree of flexible rigidity. Such encapsulation of electronic communication device **10** is described in U.S. patent application Ser. No. 08/800,037, filed Feb. 13, 1997, assigned to the assignee of the present application, and incorporated herein by reference.

In compliance with the statute, the invention has been described in language more or less specific as to structural and methodical features. It is to be understood, however, that the invention is not limited to the specific features shown and described, since the means herein disclosed comprise preferred forms of putting the invention into effect. The invention is, therefore, claimed in any of its forms or modifications within the proper scope of the appended claims appropriately interpreted in accordance with the doctrine of equivalents.

The invention claimed is:

1. A method of forming a remote communications device comprising:

electrically coupling wireless communications circuitry with an antenna construction, wherein the wireless communications circuitry is configured to implement wireless communications including at least one of processing first wireless communications signals received by the antenna construction and to control outputting of second wireless communications signals, using the antenna construction;

providing a ground plane configured to interact with the antenna construction during wireless communications of the wireless communications circuitry; and

configuring the ground plane to be at a substantially constant voltage during the wireless communications of the wireless communications circuitry, wherein, during the wireless communications of the wireless communications circuitry, the ground plane is configured to shield the antenna construction from some of the wireless communications and reflect other of the wireless communications toward the antenna construction.

2. The method of claim **1** further comprising providing a power source, and wherein the configuring the ground plane to be at the substantially constant voltage comprises configuring using the power source.

3. The method of claim **2** wherein the providing the power source comprises providing a battery.

4. The method of claim **1** wherein the configuring the ground plane to be at the substantially constant voltage comprises coupling the ground plane with a node of the wireless communications circuitry.

5. The method of claim **1** wherein the configuring the ground plane to be at the substantially constant voltage comprises grounding the ground plane.

6. The method of claim **1** further comprising providing dielectric material intermediate the ground plane and the antenna construction, and wherein the configuring the ground plane to be at the substantially constant voltage comprises configuring using an electrical connection within the dielectric material.

7. The method of claim **1** further comprising providing the antenna construction comprising a first antenna configured to receive the first wireless communications signals, and a second antenna configured to output the second wireless communications signals.

8. A wireless communications method comprising:

wirelessly communicating using an antenna of a wireless communications device, wherein the wirelessly communicating comprises at least one of receiving wireless communications signals from an interrogator and outputting wireless communications signals to be communicated to the interrogator;

interacting a conductive layer of the wireless communications device with the antenna during the wirelessly communicating, wherein, during the wirelessly communicating, the conductive layer plane is configured to sheild the antenna from some of the wireless communication signals and reflect others of the wireless communication signals toward the anntena; and

defining a voltage of the conductive layer during the wirelessly communicating.

9. The method of claim **8** wherein the defining comprises providing the conductive layer at a substantially constant voltage during the wirelessly communicating.

10. The method of claim **9** wherein the providing the conductive layer at the substantially constant voltage comprises grounding the conductive layer.

11. The method of claim **8** wherein the wirelessly communicating comprises communicating using backscatter communications.

12. A wireless communications method comprising:

receiving a wireless polling signal using an antenna of a remote communications device;

using the remote communications device, outputting a wireless identification signal;

identifying the remote communications device responsive to the receiving the wireless polling signal;

reflecting first electromagnetic energy toward the antenna of the remote communication device using a ground plane during the receiving; and

sheilding the antenna of the remote communications device from second electromagnetic energy using the ground plane during the receiving.

13. The method of claim **12** further comprising outputting the wireless polling signal using an interrogator.

14. The method of claim **12** further comprising providing the ground plane at a substantially constant voltage during the reflecting.

15. The method of claim **12** further comprising providing the ground plane at a grounded voltage reference during the reflecting.

16. A remote communications device comprising:

an antenna construction;

wireless communications circuitry coupled with the antenna construction and configured to communicate signals; and

a ground plane configured to interact with the antenna construction during operation of the wireless communications circuitry and configured to have a substantially constant voltage during the operation of the wireless communications circuitry, wherein the ground plane is configured to sheild the antenna construction from some of the signals and reflect others of the signals toward the antenna construction during operation of the wireless communications circuitry.

17. The device of claim **16** wherein the ground plane is coupled with a node which provides the substantially constant voltage of the ground plane during the operation of the wireless communications circuitry.

18. The device of claim **16** wherein the ground plane is grounded during the operation of the wireless communications circuitry.

19. The device of claim **16** further comprising a power source configured to provide operational energy to the remote communications device and to provide the ground plane at the substantially constant voltage.

20. The device of claim **19** wherein the power source comprises a battery.

21. The device of claim **16** wherein the antenna construction comprises:

a first antenna configured to receive a first wireless communications signal; and

a second antenna configured to output a second wireless communications signal.

22. The device of claim **16** wherein the wireless communications circuitry is configured to process first wireless communications signals received by the antenna construction and to control outputting of second wireless communications signals using the antenna construction.

23. The device of claim **16** wherein the wireless communications circuitry is configured to wirelessly communicate using backscatter communications.

24. A remote communications device comprising:

an antenna;

wireless communications circuitry to communicate signals, wherein the wireless communications circuitry is coupled with the antenna;

a conductive layer configured to interact with the antenna during wireless communications of the wireless communications circuitry, wherein, during wireless communications of the wireless communications circuitry, the conductive layer is configured to sheild the antenna from the some of the signals and reflect others of the signals toward the antenna; and

bias circuitry coupled with the conductive layer and configured to bias the conductive layer during the wireless communications of the wireless communications circuitry.

25. The device of claim **24** wherein the bias circuitry is configured to bias the conductive layer at a substantially constant voltage during the wireless communications of the wireless communications circuitry.

26. The device of claim **25** further comprising a power source configured to provide operational energy to the remote communications device, and wherein the bias circuitry is configured to couple the conductive layer with a terminal of the power source.

27. The device of claim **25** wherein the bias circuitry is configured to ground the conductive layer.

28. The device of claim **25** wherein the bias circuitry comprises a node of the wireless communications circuitry.

29. A remote communications device comprising:

a housing;

an antenna construction coupled with the housing;

wireless communications circuitry coupled with the housing and the antenna construction, wherein the wireless communications circuitry is configured to communicate signals, and is further configured to implement wireless communications of the remote communications device using the antenna construction; and

a ground plane coupled with the housing and configured to interact with the antenna construction during the wireless communications of the remote communication device, wherein the ground plane is provided at a substantially constant voltage during the wireless communications, wherein, during wireless communications of the wireless communications circuitry, the ground plane is configured to sheild the antenna construction from the some of the signals and reflect others of the signals toward the antenna construction.

30. The device of claim **29** wherein the antenna construction comprises:

a first antenna configured to receive a first wireless communications signal; and

a second antenna configured to output a second wireless communications signal.

31. The device of claim **29** wherein the ground plane is grounded during the wireless communications.

32. A radio frequency identification device comprising:

an antenna construction configured to receive a wireless polling signal and to output a wireless identification signal, wherein the wireless identification signal identifies the radio frequency identification device;

a ground plane configured to reflect first electromagnetic energy toward the antenna construction during the receiving of the wireless polling signal and to sheild the antenna from second electromagnetic energy during the receiving of the wireless polling signal; and

processing circuitry coupled with the antenna construction and configured to receive an electrical signal corresponding to the wireless polling signal received by the antenna construction and to control the outputting of the wireless identification signal responsive to the wireless polling signal.

33. The device of claim **32** further comprising circuitry configured to provide the ground plane at a substantially constant voltage during at least one of the receiving the wireless polling signal and the outputting the wireless identification signal.

34. The device of claim **33** wherein the circuitry is configured to couple the ground plane with a power source to provide the ground plane at the substantially constant voltage.

35. The device of claim **33** wherein the circuitry is configured to couple the ground plane with a ground terminal of the power source to provide the ground plane at the substantially constant voltage.

36. The device of claim **32** wherein the processing circuitry is configured to process the electrical signal and to control the outputting of the wireless identification signal responsive to the processing.

37. The device of claim **32** wherein the processing circuitry is configured to control backscatter modulation to control the outputting of the wireless identification signal comprising a backscattered signal.

38. A wireless communications system comprising:

an interrogator configured to implement wireless communications including communicating wireless communications signals;

a remote communications device remotely located with respect to the interrogator and configured to implement wireless communications including communicating the wireless communications signals via an antenna; and

wherein the remote communications device comprises a ground plane configured to reflect first electromagnetic energy toward the antenna and to sheild the antenna from second electromagnetic energy during the wireless communications of the remote communications device, and wherein the ground plane is provided at a substantially constant voltage during the wireless communications of the remote communications device.

39. The system of claim **38** wherein the interrogator is configured to implement the respective wireless communications including outputting the wireless communications signals and the remote communications device is configured to implement the respective wireless communications including receiving the wireless communications signals.

40. The system of claim **38** wherein the ground plane is grounded during the wireless communications.

41. The system of claim **38** wherein the remote communications device is configured to backscatter modulate electromagnetic energy outputted by the interrogator to output the wireless communications signals.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,948,382 B2
APPLICATION NO. : 11/519246
DATED : May 24, 2011
INVENTOR(S) : Mark E. Tuttle

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the cover page after (74) Attorney, Agent, or Firm — "Mentilik" should read --Mentlik--.

Column 4, line 36, after "such" delete "4".

Column 8, line 53, "sheild" should read --shield--.

Column 9, line 32, "sheild" should read --shield--.

Column 10, line 5, "sheild" should read --shield--.

Column 10, line 6, delete the first occurrence of "the".

Column 10, line 41, "sheild" should read --shield-- and delete the second occurrence of "the".

Column 10, line 59, "sheild" should read --shield--.

Column 12, line 7, "sheild" should read --shield--.

Signed and Sealed this
Twenty-ninth Day of May, 2012

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office